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Sizewell C
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Sizewell C Project
Combustion Activity Permit Application
Appendix L: Mitigation Strategy

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1 PURPOSE

This Mitigation Strategy document has been prepared to support the Sizewell C (hereafter SZC) Ltd permit application for an installation activity environmental permit, EPR Schedule 1, Section 1.1A(1)(a): Burning of any fuel in an appliance with a rated thermal input of 50 Mega Watt (MW) or more. An Environmental Permit is required for SZC as per the Environmental Permitting (England and Wales) Regulations 2016, as amended.

This Mitigation Strategy has been developed to demonstrate the potential measures which could be undertaken to mitigate or off-set the potential impacts from emissions to air associated with the use of generators as part of the combustion activity permit. A number of these measures have already been adopted as good practice in order to minimise the potential impact from the project and those measures, detailed within the conclusion to this report, have been taken into account in the Air Emission Risk Assessment (Ref 1) and Habitats Regulations Assessment (HRA) (Ref 2).

2 DEFINITIONS AND REFERENCES

2.1 Definitions

Term / Abbreviation	Definition
CES	Construction Electrification Supply
EA	Environment Agency
EDRMS	Electronic Document and Records Management System
GTL	Gas to Liquid
HRA	Habitats Regulations Assessment
HVO	Hydrotreated Vegetable Oil
kV	Kilovolt
KvA	Kilovolt Amp
MCA	Main Construction Area
MEP	Mechanical, Electrical and Plumbing
MW	Mega Watt
MWth	Mega Watt Thermal
NG	National Grid
NOx	Nitrogen Oxides
SAC	Special Areas of Conservation
SCADA	Supervisory Control and Data Acquisition
SPA	Special Protection Area
SZB	Sizewell B
SZC	Sizewell C
TCA	Temporary Construction Area

2.2 References

Ref	Title	Location	Document No.
1	Air Emission Risk Assessment (Appendix C of the Supporting Information Document)	EDRMS	101254803
2	The Construction Permitting HRA Report (Appendix K of the Supporting Information Document)	EDRMS	101254844
3	Bobbink R, Loran C and Tomassen H (2022) Review and Revision of Empirical Critical Loads of Nitrogen for Europe. Report for the German Environment Agency.	Publication	n/a
4	Development Consent Order shadow HRA the Shadow Habitats Regulations Assessment Volume 1 (EN010012-001765-SZC_Bk5_5.10_V1_Shadow_HRA_Report_Part_1_of_5.pdf (planninginspectorate.gov.uk))	Website	n/a

Ref	Title	Location	Document No.
5	Integrated Emissions Management Protocol (Appendix F of the Supporting Information Document)	EDRMS	101254830

3 SUMMARY DESCRIPTION OF THE PROPOSED COMBUSTION ACTIVITY

The total combustion activity capacity, using generators during the construction phase, is anticipated to reach an aggregated thermal capacity input in excess of 50 Megawatt Thermal (MWth). Due to the potential for the threshold to be reached, it has been agreed with the Environment Agency (EA) to apply for the >50 MWth permit straight away rather than apply for a Medium Combustion Plant permit. This approach will allow flexibility in the operating profile of the generators throughout the construction phase.

For a short period of 3 to 4 years, during the early construction years of the power station, there will be a need to use diesel generators. There will be an increasing generator use in 2024 and 2025. Currently it is estimated that the peak demand is for a 12 to 18 month period, starting in 2025. During this time, the project is looking to utilise a number of 1250 Kilovolt Amps (KvA) (2400 Kilowatt Thermal) generators located around the construction site which are strategically positioned where the eventual connected electricity supply will become available. Presently it is not possible to profile the demand from these generators, but the peak demand is estimated on a moderately conservative basis to be around 82 MWth. Ahead of the expected peak period in 2025/2026, the capacity of the generators would likely be below the 50 MWth threshold.

A Construction Electrification Supply (CES) will be provided as soon as practicable, scheduled to be commissioned in 2027. Stage V emission generators with hybrid batteries are a key requirement of the project and wherever possible, will be used to bridge the gap through the early years of the construction prior to installation of the CES. During this time, the generators are there to provide power to support construction activities and to create a safe working environment for people working on the site, including welfare buildings, heating and lighting.

There is the potential that the CES may be available prior to the site demand exceeding 50 MWth. After installation of the CES, it is expected that where practicable the power demand will use this CES, however there may be a small number of generators needed. In addition to the CES, SZC is seeking to utilise power through an early electrical connection from Sizewell B which will significantly reduce the power demand from generators in the first 2-3 years. This supply may not always be 100% available and there may be times where Sizewell B (SZB) require the power to support its operation or in shutdown/maintenance scenarios.

The proposed activity scenario, which the air quality modelling has been based upon to support this permit application, is considered to be moderately conservative, based on estimates of the installed capacity and it allows some headroom for the site's evolving requirements. The conservatism is based upon:

- Being based on the best available information for the early works power needs (2024) and the current estimates based on the peak generator power year in 2025/2026 ahead of the CES becoming available;
- Potential for early CES availability;
- Potential SZB connection; and
- Overall duration over which the generators will be operational, between the start of construction and CES connection. This will be short in comparison to the overall construction period of the build.

4 MITIGATION PHILOSOPHY

There are a number of potential measures that can be adopted with regards to mitigating (reducing the potential impact through other measures) or off-setting (undertaking alternative measures to compensate for any effects identified) the potential impacts from emissions to air associated with the use of generators as part of the combustion activity permit. These generally fall into 3 categories which are:

- Operational measures;
- Technological measures; and
- Off-setting arrangements.

Each of the available options with regards the above categories of potential mitigation measures are discussed in turn below.

5 OPERATIONAL MEASURES

There are several potential operational measures which can be implemented with the generators which could mitigate their potential impact and are discussed below.

Construction Electrification Supply (CES): Electricity will be provided via a dual circuit 132 kilovolt (kV) supply from the local National Grid (NG) Leiston substation to a new 132/11kV CES substation in the SZC main development site. An 11kV supply network will then be distributed to the wider construction site as needed.

The works to provide the CES include the installation of indoor sealing end structures and termination cables for the new 132kV circuit in the NG Leiston substation. A 2.5km dual cable run will be excavated and installed between the NG substation and the new CES substation. The CES works entail the installation of two 132/11kV transformers and the associated civils works. The new substation will consist of a switch house with a raised floor to create an under-croft for cables and include the installation and commissioning of switchgear, protection panels, Supervisory Control and Data Acquisition (SCADA) systems and mechanical, electrical and plumbing (MEP) services. The supply from the CES will be via an 11kV cable infrastructure to package substations at selected locations across the construction site for distribution to supply points.

The main mitigation strategy for the proposed permitted activity will be the implementation of the CES, in 2027, which will provide mains power to the majority of the construction site. This will significantly reduce the requirement for the operation of the diesel generators and hence the associated emissions. As the operating hours for the generators are reduced, there will be a corresponding reduction in the emissions to air and therefore the potential environmental impact will be minimised.

Generator Rationalisation: During the early site establishment phase of the project, each building or site set up is powered by its own set of generators. Discussions are ongoing with SZB to obtain a supply connection to the Main Construction Area (MCA) in Q3 2024. This is expected to reduce the number of generators required at the MCA. Furthermore, the project is exploring the possibility to use the mains connection to the redundant Sizewell B District Survey Laboratory, a disused building, next to the Temporary Construction Area (TCA). Coupled with a battery storage solution, this arrangement would optimise the utilisation of this electrical connection to power some areas of the TCA, thereby further reducing dependency on generators.

As part of the generator strategy being developed for the works, package substations will be installed at specified permanent locations and powered by generators before sitewide electrification. The package substations will be connected to multiple buildings and site locations, eliminating the need for each building or site set-up to have its own generator and streamlining generator usage.

Upon commissioning, the CES electricity will be distributed to the package substations installed earlier as part of the generator strategy. As the construction works develop, the package substation may be moved to suit the project needs; however, the electricity supply principles will remain the same.

After site electrification, some generators will still be necessary as emergency back-up for critical buildings and for specific construction activities, particularly those requiring uninterrupted power.

The rationalisation of generators will be controlled through a permit system which is described within the Supporting Information Document.

Diesel Alternatives: The use of alternative fuels is also considered an option available to the SZC construction site for fuelling various plant and equipment on site. Two such fuels that could be considered for use on site are Gas to Liquid (GTL) fuel and Hydrotreated Vegetable Oil (HVO), which are both 'drop in fuels' that provide direct replacement for conventional diesel fuels. These alternative fuels provide a number of benefits including a reduction in both Particulate Matter and Nitrogen oxides (NOx) emissions to a varying degree depending on appliance and engine type.

Independent testing on the efficacy of the two fuels to reduce emission levels versus conventional diesel has been commissioned by the principal supplier of generators to the Project. The tests were conducted to ISO8178 D2 Cycle (constant speed engine) on all three fuels, EN590 Diesel, Green D+ (HVO) and GTL. The fleet used were all 'In Service' generators ranging in lifetime running hours between 9,000 to 12,000 that had been fully serviced and load tested prior to the emission test. The engines used had different internal designs to achieve their initial Stage IIIA classification to offer a broader picture of how the alternative fuels would perform across a diverse fleet.

The reductions in emissions recorded can be up to 20% for Hydrocarbons and NOx combined for gensets, although the study was for smaller models than the ones to be used at SZC because of the larger gensets to be used because of the hybridisation model. Both fuels had a fuel penalty due to the lower calorific values of the green fuels, these range between 0.1% - 2.9% for HVO fuels and 0.8% - 4.9% for the GTL. Therefore, a greater volume of fuel would be required to deliver the same electrical output as diesel given the fuel penalty meaning there is only a small benefit of using HVO when compared to diesel with regards to potential emissions.

It is considered that the use of the diesel alternative fuels could be trialled in order to demonstrate their effectiveness in comparison with diesel especially with regards to emissions and energy efficiency.

Currently, some of the site static diesel hybrid generators used for the early works welfare facilities are powered by HVO. The Project is engaging with the HVO supply chain to ensure that the fuel requirements of the Project can be met if a transition to HVO is made for a larger number of generators.

There are no plans for the site to adopt the use of GTL at this time because it has a higher fuel penalty compared to diesel than HVO. However, the EA will be notified should this change.

6 TECHNOLOGICAL MEASURES

There are several potential technological measures which can be implemented with the generators which could mitigate their potential impact and are discussed below.

Hybrid Units: The benefit of hybrid generators is that at low loads or whilst idling, the diesel generator is switched off, and the load is provided by an internal/external storage battery instead. As such, these units provide a significant reduction in diesel run time by utilising battery storage when available, switching to diesel operation when required which also concurrently recharges the battery.

The advantage of these systems is that they appear to be able to provide reliable power 24/7 for the construction site but for the environmental permit these types of systems do not reduce the installed capacity of generators on site. However, the reduction in run time of the diesel generator could be up to 50% which could significantly reduce emissions. The hybrid generator units to be used at SZC have proven to work effectively through their use at Hinkley Point C and as such will be adopted where appropriate at SZC.

Further investigation into the application of hybrid units with the supplier has identified that they are not currently feasible on the larger generators (>100kVA), where the key fuel and emission savings can be made. This is because they have a limit on the maximum current (amps) they can receive, which will be exceeded by the peak loads experienced on the generators during start up and also linked to lifting heavier loads (on generators powering tower cranes) which would result in the failure of the entire system.

Generator Stack Heights: There remains the option of increasing the stack heights associated with generators in particularly sensitive locations to provide for greater dispersion of any potential pollutants. The Construction Permitting HRA Report concludes that there would be no adverse effect on the integrity of any European sites as a result of the three years of forecast emissions and resulting nitrogen deposition from the generators alone, or in combination with other plans or projects. Therefore, consideration of technological changes to stack height are not considered necessary at this point.

Selective Catalytic Reduction: Selective catalytic reduction has been included with regards some of the larger generators, over 100 kVA, associated with the packaged substations in order to reduce their emissions of oxides of nitrogen. These do however have the potential to release ammonia if generators are not managed effectively with regards to their maintenance and management of ad blue as a reagent. Reagent dose rates are monitored as well as the generators being serviced approximately 500 operational hours which should help to optimise emissions from the larger generators.

PUNCH Flybrid: A new technology identified as a potential measure to reduce emissions from the SZC site is the PUNCH Flybrid system, which is essentially a mobile flywheel energy storage technology.

The containerised unit works by capturing waste energy from the generator and storing it in a high-speed energy storage flywheel. The recuperated energy can then be used to balance peaks in dynamic duty cycles, for example on the tower crane units at SZC.

The application of this unit may enable the larger generators, which are sized for peak loads on the tower cranes, to be reduced to a smaller generator sized for the average load that will have a lower fuel consumption and therefore emissions.

Given the adoption of hybrid generators into the Project it was considered that the implementation of a new and unknown technology, with respect to the Project, is not required to be adopted.

Renewables: Whilst renewables have been ruled out from providing the electricity across each of the 3 construction zones with regards the overall provision of electricity, there is the potential to use a combination of solar and/or micro turbines with associated batteries for localised generation of electricity for low demand activities and this is being actively considered.

7 ECOLOGICAL MANAGEMENT

7.1 Habitat Management Measures

Review of information on Air Pollution Information System identifies that dune systems and heathlands were historically managed by grazing (sheep, horses, cattle) which help remove nutrients, but can accelerate nitrogen cycling and cause damage by trampling and overgrazing. The scale of impacts needs to be understood in relation to the interactions between deposition from emissions to air and management practices (burning and grazing). Management intervention can reduce impacts of nitrogen through removal via burning and sod cutting.

This supports the information obtained from Bobbink et al (2022) (Ref 3) and other sources that improvement, higher intensity management can serve to make heathland, acid grassland and vegetated sand dune habitat more generally resilient to negative effects (including but not limited to nitrogen deposition) and thus result in a higher critical load. Introducing additional management to the most affected areas of acid grassland, heathland and sand dune in Minsmere to Walberswick Heaths and Marshes Site of Special Scientific Interest (SSSI) and Leiston-Aldeburgh SSSI would therefore improve the resilience of these habitats and ensure no significant effect results from operation of the generators.

7.2 Off-setting

Biodiversity offsetting is for projects that will cause unavoidable damage or a loss of biodiversity, such as the degradation of an area of natural habitat or the population of a species being reduced. These projects are expected to fully compensate for any damage through measurable, long-term conservation actions.

- The Construction Permitting HRA Report (Appendix K of the Supporting Information Document, 101254844) concludes that there would be no likely significant effects as a result of the Permit on the following European sites within 10km of the Permit application site; Outer Thames Estuary Special Protection Area (SPA), Alde-Ore Estuary SPA/Alde-Ore and Butley Estuaries Special Area of Conservation (SAC), Southern North Sea SAC, Dews Pond SAC and Orfordness-Shingle Street SAC. Likely Significant Effects were identified for Sandlings SPA, Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick SPA and Ramsar site; however, it was determined, through detailed assessment, that there would be no adverse effects on the integrity of these sites because noise impacts on the qualifying features of Minsmere-Walberswick SPA and Ramsar site would be insignificant and in relation to air quality, impacts at Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick SPA and Ramsar and Sandlings SPA would not result in adverse effects on the integrity of the sites because:
- The impacts discussed in the HRA Report are temporary, lasting a total of approximately three years (c. 2024/25 – 2027/28). They therefore will not affect long-term nitrogen deposition or ammonia concentrations which are most relevant for affecting habitats and species.
- As reported in the Development Consent Order shadow HRA (Ref 4), for nitrogen deposition there is evidence that at high background deposition rates such as are currently experienced at both European sites the degree of botanical change in most parameters from incremental further additions of nitrogen is much smaller than at low background deposition rates.
- The impacts of the generators for this temporary period must be considered within the context of the longer term (effectively permanent) changes in the landscape being delivered by the SZC Project which is removing large areas of agricultural land (a major source of ammonia and nitrogen) from arable production.

For the reasons above, consideration of off-setting arrangements has not been undertaken given that there is not predicted to be any impact on a European site and given the short-term temporal requirement of the environmental permit.

8 CONCLUSIONS

The above measures provide a range of potential operating, technological and off-setting measures that can be adopted by the Project to lessen the potential impact of generators.

Measures to be implemented as part of the project strategy include hybridisation of the generators to allow for reduced running on diesel and early electrification. Generators will be strictly controlled via a permit to work process to ensure that the correct generators are supplied and that they are consistent with the demand as detailed within this environmental permit application.

The findings of the Construction Permitting HRA Report conclude that there would be no adverse effect on the integrity of any European sites as a result of the forecast emissions and resulting nitrogen deposition from the generators alone, or in combination with other plans or projects. Therefore, any of the further mitigation measures detailed above would only be considered should there be an identified impact associated with the ambient air quality monitoring, at a human or ecological receptor, as detailed within the Integrated Emissions Management Protocol (Ref 5).

APPENDIX L: MITIGATION STRATEGY

A summary of the considered mitigation measures and those that will or may be implemented and those that are not considered to be required are detailed in the table below:

Mitigation Category	Operational Measures			Technological Measures				Ecological Measures	
Mitigation Measures	Construction Electrification Supply	Generator Rationalisation	Diesel Alternatives	Hybrid Units	Generator Stack Heights	Selective Catalytic Reduction	PUNCH Flybrid	Habitat Management	Off-Setting
Proposed at SZC	✓	✓	?	✓	X	✓	X	X	X

✓	Mitigation measure will be implemented
?	Mitigation measure could be further considered
X	Mitigation measure not required